SUPPORT FOR THE AMENDMENT

This Amendment amends Claim 11. Support for the amendments is found in the specification and claims as originally filed. In particular, support for Claim 11 is found in the specification at least at page 4, line 17 ("Preferably, the lower limit of Si is about 1.2% ..."). No new matter would be introduced by entry of these amendments.

Upon entry of these amendments, Claims 11-14, 43-46 and 48-50 will be pending in this application. Claim 11 is independent.

REQUEST FOR RECONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

The present invention provides a hard-drawn steel wire allowing springs made of the wire to exhibit excellent fatigue strength and sag resistance even without subjecting a drawn wire to quenching and tempering treatments. Specification at page 1, lines 7-9. The hard-drawn wire consists of ferrite and/or pearlite, contains C in an amount of 0.5 - 0.68 mass% and Si in an amount of 1.2 - 1.95 mass%, and comprises 5 particles/100μm^2 or less of carbides wherein the circle-equivalent diameters of the carbides are more than 0.1 μm. The C content of 0.68 mass% or less inhibits fracture in performing works and the occurrence of cracks that deteriorate fatigue life. Specification at page 4, lines 4-6. The Si content enhances sag resistance, without degrading fatigue strength. Specification at page 4, lines 11-18. The limited number of large carbides in the hard-drawn wire, which consists of ferrite and/or pearlite, provides improved fatigue strength and sag resistance equal or superior to that of an oil-tempered wire consisting of tempered martensite generated by the quenching and tempering treatment. Specification at page 2, lines 13-16; page 3, lines 15-25.

Claims 11-14, 43-46 and 48 are rejected under 35 U.S.C. §103(a) over Japanese Patent No. 7-90495 ("JP-495") in view of U.S. Patent No. 6,645,319 ("Nagao") or Japanese Patent No. 8-120407 ("JP-407").

JP-495 discloses a steel wire containing **0.7-1.0 wt% C**, ***1.0 wt% or less of Si***, and 0.05-1.0 vol% of **carbide** of V or Nb having a size of **0.1 μm or less**. JP-495 discloses that C less than 0.7 wt% causes deterioration of strength (JP-495 at column 2, line 40) and the size of carbide of V or Nb more than 0.1 μm impairs workability (JP-495 at column 3, lines 10-11).

JP-495 fails to suggest the independent Claim 11 limitations of a "hard-drawn steel wire comprising: **C: 0.5 - 0.68 mass%** ... , ***Si: 1.2-1.95%***, ..., said wire ... further comprising 5 particles/100μm^2 or less of carbides wherein the circle-equivalent **diameters of the carbides** are **more than 0.1 μm** ".

Nagao discloses a wire rod for drawing that contains C: 0.65-1.2 mass% and Si: 0.1-2.0 mass%. Nagao at abstract, column 3, lines 46 and 62. Nagao discloses that the Si functions as a deoxidizer. Nagao at column 3, line 63.

JP-407 discloses steel wire, having high strength, high toughness and high ductility, that is essentially composed of one or more structures selected from the group consisting of fine pearlite, pseudo-pearlite, and bainite. JP-407 also discloses that the average grain size of carbides in the structures is regulated to 10-50 nm. JP-407 at English-language abstract.

Any *prima facie* case of obviousness based on the cited prior art is rebutted by the significant improvement in the combination of fatigue strength and sag resistance that is achieved by the present invention in accordance with independent Claim 11 with a steel wire "comprising: C: 0.5 - 0.68 mass% ..., Si: 1.2-1.95%, ... further comprising 5 particles/100μm^2 or less of carbides wherein the circle-equivalent diameters of the carbides are more than 0.1 μm".

This is demonstrated in the specification at Tables 1-2, reproduced below.

In Table 2, the "residual shear strain" is used as an index of sag resistance (a smaller residual shear strain means a better sag resistance). The "fatigue life" is a measure of fatigue strength (a higher fatigue life means a better fatigue strength). Specification at page 12, lines 14-17.

Table 1

Kind of Steel	Chemical Composition (mass%)					
	C	Si	Mn	Cr	Ni	Mo
A	0.65	1.45	0.82	0.85	–	–
B	0.53	1.53	0.75	1.00	–	–
C	0.65	1.91	0.90	0.64	–	–
D	0.61	1.36	0.59	1.45	–	–
E	0.82	0.25	0.71	–	–	–
F	0.92	0.25	0.75	–	–	–
G	0.80	1.90	0.85	0.85	–	–
H	0.45	1.41	0.72	0.69	–	–
I	0.62	1.35	0.79	1.68	–	–
J	0.60	1.51	0.83	0.92	0.21	–
K	0.55	1.47	0.78	0.82	0.23	0.18

Table 2

No.	Kind of Steel	Austenitizing Temperature for Patenting (°C)	Tensile Strength TS (MPa)		Number of Carbides (particles/ 100 μm^2)	Surface Roughness Ry (μm)	Nitriding	Residual Shear Strain ($\times 10^{-4}$)	Fatigue Life ($\times 10^6$ cycles)
			After Drawing	After Stress relief annealing					
1	A	930	1915	1911	0	9.8	NOT	4.2	10.1
2	A	900	1881	1901	2	6.7	NOT	5.3	8.7
3	A	890	1853	1898	5	8.4	WITH	3.7	15.8
4	A	940	1944	1941	0	12.4	NOT	4.8	5.3
5	B	920	1938	1870	1	5.5	NOT	3.1	9.1
6	C	930	1955	2054	0	7.9	NOT	1.9	11.5
7	D	950	1910	1874	0	9.2	NOT	2.2	10.7
8	A	870	1843	1732	8	8.6	NOT	11.1	3.1
9	E	910	1770	1668	0	5.8	NOT	10.1	2.5
10	F	950	1953	1742	0	8.3	NOT	12.8	0.9
11	G	940	1831	1845	0	7.3	NOT	9.5	4.6
12	H	880	1743	1652	0	9.8	NOT	12.5	1.0
13	I	920	1733	1796	12	8.3	NOT	10.8	2.9
14	J	900	1921	1953	0	7.2	NOT	3.5	10.4
15	K	930	1967	1999	0	8.3	NOT	2.7	12.6

In Table 2, comparative sample Nos. 9-10 contain 0.82% and 0.92% C, respectively, outside the Claim 11 range of "C: 0.5 - 0.68 mass%"; 0 carbide particles/100 μm^2, within the Claim 11 range of "5 particles/100μm^2 or less of carbides wherein the circle-equivalent diameters of the carbides are more than 0.1 μm"; and **0.25% Si**, outside the Claim 11 range of "Si: 1.2-1.95%".

Comparative sample No. 8 contains 8 carbide particles/100μm^2, outside the Claim 11 range of "5 particles/100μm^2 or less of carbides wherein the circle-equivalent diameters of the carbides are more than 0.1 μm".

Comparative sample Nos. 11-12 contain 0.80 and 0.45% C, outside the Claim 11 range of "C: 0.5 - 0.68 mass%".

In contrast, inventive sample Nos. 1-7 and 14-15 meet the requirements of the present invention. The alloys A, B, C, D, J and K used in sample Nos. 1-7 and 14-15 all contain C within the Claim 11 range of "C: 0.5 - 0.68 mass%"; a number of carbides within the Claim 11 range of "5 particles/100μm^2 or less of carbides wherein the circle-equivalent diameters of the carbides are more than 0.1 μm"; and Si within the Claim 11 range of "**Si: 1.2-1.95%**".

Inventive sample Nos. 1-7 and 14-15 exhibit "residual shear strain" ranging from 1.9 to 5.3, which is significantly less than the "residual shear strain" of 10.1 and 12.8 of comparative sample Nos. 9-10, and the 11.1, 9.5 and 12.5 of comparative sample Nos. 8 and 11-12, and which indicates significantly improved sag resistance.

Inventive sample Nos. 1-7 and 14-15 also exhibit "fatigue life" ranging from 5.3 to 15.8, which is higher than the "fatigue life" ranging from 0.9 to 4.6 of comparative sample Nos. 8, 9-10 and 11-12, and which indicates improved fatigue strength.

The cited prior art is silent about the effect of C and Si on sag resistance. As discussed above, Nagao discloses that the Si functions as a deoxidizer. Nagao at column 3, line 63.

Because the cited prior art fails to suggest the significant improvement in the combination of fatigue strength and sag resistance that is achieved by the present invention in accordance with independent Claim 11 with a steel wire "comprising: C: 0.5 - 0.68 mass% ..., Si: 1.2-1.95%, ... further comprising 5 particles/100μm^2 or less of carbides wherein the circle-equivalent diameters of the carbides are more than 0.1 μm", any *prima facie* case of obviousness based on the cited prior art is rebutted.

As a result, the rejection under 35 U.S.C. § 103(a) should be withdrawn.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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